

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (Original): A switching power supply unit comprising:
a transformer;
a switching circuit provided on the primary side of the transformer;
a synchronous rectifier circuit provided on the secondary side of the transformer and having at least a rectifier transistor;
a rectifier-transistor driving circuit provided on the secondary side of the transformer and forming a first control signal synchronous with a switching operation of the switching circuit; and
a timing generating circuit which receives the first control signal for forming a second control signal which exceeds a threshold voltage of the rectifier transistor at a timing substantially equal to the timing that one edge of the first control signal is generated based on the first control signal and which falls below the threshold voltage of the rectifier transistor at a timing earlier by predetermined time than the timing the other edge of the first control signal is generated, and for supplying the resulting second control signal to the control electrode of the rectifier transistor.

Claim 2 (Original): The switching power supply unit as claimed in claim 1,
wherein the waveform of the first control signal is a waveform alternately repeating a first potential, a second potential and an intermediate potential between the first and second potentials;

wherein the one edge of the first control signal is defined by the timing the one edge varies from the first potential to the intermediate potential, and the other edge of the first control signal is defined by the timing the other edge varies from the intermediate potential to the first potential.

Claim 3 (Original): The switching power supply unit as claimed in claim 2, wherein during the interval the first control signal varies from the intermediate potential to the first potential after the first control signal varies from the second potential to the intermediate potential, the voltage of the second control signal falls below the threshold voltage of the rectifier transistor.

Claim 4 (Original): The switching power supply unit as claimed in claim 3, wherein the timing generating circuit including:

a first unit which receives the first control unit for forming an intermediate signal which varies from a first logical level to a second logical level in response to the one edge of the first control signal and varies from the second logical level to the first logical level in response to the variation of the first control signal from the second potential to the intermediate potential; and

a second unit which receives the intermediate signal for forming the second control signal by providing a delay to the variation of the intermediate signal from the second logical level to the first logical level.

Claim 5 (Original): The switching power supply unit as claimed in claim 4, wherein the first unit including:

a divider circuit for dividing the first control signal;

a delay circuit for delaying the output signal of the divider circuit; and
a comparator for comparing the first control signal with the output signal of the delay circuit whereby to form the intermediate signal.

Claim 6 (Original): The switching power supply unit as claimed in claim 5, wherein the delay circuit including:

a first time-constant circuit for providing a delay to the one-directional variation of the output signal of the divider circuit; and
a second time-constant circuit for providing a delay to the reverse-directional variation of the output signal of the divider circuit.

Claim 7 (Original): The switching power supply unit as claimed in claim 6, wherein the time constant of the first time-constant circuit is set so that the potential of the output signal of the delay circuit rises above at least the intermediate potential at the timing that the first control signal varies from the second potential to the intermediate potential

wherein the time constant of the second time-constant circuit is set so that the potential of the output signal of the delay circuit falls below at least the intermediate potential at the timing the first edge of the first control signal is generated.

Claim 8 (Original): The switching power supply unit as claimed in claim 1, wherein the switching circuit is one selected from a half-bridge circuit, a full-bridge circuit, a push-pull circuit and an active clamping circuit.

Claims 9-11 (Canceled)

Claim 12 (Currently Amended): A switching power supply unit comprising:
a first switching element and a second switching element which are provided on the
primary winding side of a transformer and connected to a power supply in series;
a converter having a first synchronous rectifying switch element and a second
synchronous rectifying switch element which are connected to the secondary winding side of
the transformer in series; and
a driving circuit for controlling the operation of the first and second switching
elements and generating a first control signal and a second control signal both having a dead
time period in which the first and second switching elements are not conducting.

~~The switching power supply unit as claimed in claim 11, wherein the dead time of the~~
first and second control signals generated by the driving circuit is a period or longer resulting
from subtracting a commutation period due to leakage inductance from the transformer from
delay time in the operation of the synchronous rectifying switch element and is a period
shorter than time resulting subtracting the commutation period from a half period of the first
control signal.

Claim 13 (Currently Amended): The switching power supply unit as claimed in claim
~~11 12~~, wherein an inductor is provided in one input portion on the primary winding side of
the transformer, the inductor being used for causing the first and second switching elements
to carry out soft switching during the dead time period.

Claim 14 (Currently Amended): The switching power supply unit as claimed in claim 11 12, wherein a preceding-stage converter including at least one switching element is provided at the preceding stage of the converter.

Claim 15 (Original): The switching power supply unit as claimed in claim 14, wherein the converter has a fixed duty and the preceding-stage converter performs pulse width control.

Claim 16 (Currently Amended): The switching power supply unit as claimed in claim 11 12, wherein the converter is a half-bridge converter.

Claim 17 (Original): The switching power supply unit as claimed in claim 16, wherein the half-bridge converter includes:

a half-bridge circuit having a first capacitor and a second capacitor provided on the primary winding side of the transformer and a first switching element and a second switching element which are connected to the power supply in series; and

a self-drive type synchronous rectifying circuit having a first and a second synchronous rectifying switch element connected to the secondary winding side of the transformer in series.

Claims 18-22 (Canceled).